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## PUGILLUS ASTRAGALORUM XII: SOME PROBLEMS IN CALIFORNIA

R. C. BARNEBY\*

In the course of preparing an account of *Astragalus* for a proposed new Manual of the California Flora, I have run into a number of minor problems of identity and synonymy. These form the subject of this paper. A short list of species erroneously accredited to the state is also appended. The following notes are based principally on material generously made available by the curators of California Academy of Sciences (CAS), New York Botanical Garden (NY) and Pomona College (POM), and in the herbarium of H. D. Ripley and the writer (RB).

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*Astragalus stenophyllus* T. & G. var. *residuus* (Jeps.), comb. nov.

*A. filipes* var. *residuus* Jeps., Man. Calif., 571, 1925.

*Homalobus Macgregorii* Rydb., Bull. Torr. Club 50:270, 1923. *A. Macgregorii* (Rydb.) Tidestr., Proc. Biol. Soc. Wash. 50:20, 1937.

Granted that *A. filipes* Torr. ex Gray (1864) is no more than a slender northern form, with strigulose pod, of *A. stenophyllus* T. & G. (1838), for which *A. stenophyllus* var. *filipes* (Torr.) Tidestr. is available, the present Californian race must be subordinated to the older species. The var. *residuus* differs from typical *stenophyllus* merely in the more copiously pubescent herbage and strigose pod, but its range is fully disjunct. The southern limits of *A. stenophyllus* proper are the Klamath Basin and Lassen County in California, and the Humboldt River drainage in central Nevada, whereas var. *residuus* occupies the inner ranges of Southern California, from Mt. Pinos to northern Baja California.

On account of the similarity in pod, var. *residuus* has been confused with *A. Antisellii* Gray, but is readily distinguished by its strictly erect, wholly herbaceous stems, which are naked at the base except for the lowermost, connate-sheathing stipules. The stems of *Antisellii* are diffuse, from an indurated caudex, and the stipules are all petiolar-cauline and free. On Mt. Pinos var. *residuus* occupies a zone between 4,500 and 5,900 feet altitude, well above that of *Antisellii*, which is commonest in the foothills, exceptionally extending up to the 4,000 ft. contour.

ASTRAGALUS NUTANS Jones, Rev. Astrag., 108, Pl. 12, 1923.

*A. chuckwallae* Abrams, Ill. Fl. Pac. St. 2:586, fig. 2834, 1944.

*A. allochrous* sensu Munz, Man. S. Calif. 267, 1935; non Gray.

The species *nutans* and *chuckwallae*, apparently confined to the northeastern Colorado and eastern Mojave deserts, are identical in every respect

\*Wappingers Falls, New York.

but one: in the former the pod, commonly described as "stipitate," is elevated on a filiform production of the receptacle, or gynophore, 1.5–2 mm. long, and jointed to it; while that of *chuckwallae* is seated on, and at length articulate with a minute boss within the calyx. True *nutans* seems still to be known only from the Providence and Old Dad ranges, while *chuckwallae* is slightly to the north in the New York Mts. (Leastalk, *Parish 10364*; Keystone Spring, *Munz 13852*, both POM) and well to the south at the type-locality in the Chuckwalla Mts. Since the form with produced receptacle occupies a small island in the other's range, and lacks supporting characters, it is perhaps best interpreted as a remarkable forma. The close relationship of this species to *A. Wootoni* and *A. insularis*, in which the pod is always sessile in the calyx, suggests that the *chuckwallae* state is probably the basic species, the production of a gynophore being a local and recent modification.

*ASTRAGALUS WHITNEYI* Gray, *sensu ampliato*.

After renewed study of the variation in stature, pubescence, and in size of flower and pod in *A. Whitneyi* (here including *A. Hookerianus* auct. and several Rydbergian segregates), I have been able to make out five fairly well defined geographic races, separable as follows:

a. Ovary and pod glabrous (b)

b. Pubescence appressed or subappressed, composed of short hairs, variable in quantity, the herbage thus glabrate to silvery-strigose; leaflets openly disposed along the rachis, the leaves of narrow outline (c)

c. Raceme usually short, 1–3 (4) cm. long in fruit; pod relatively small, 1.5–3 (averaging 2.5) cm. long. Sierra Nevada, from Alpine to Inyo counties; Mt. Pinos; White Mts.; east to Mt. Rose and Humboldt County, Nevada ..... *A. Whitneyi* (typical)

c. Raceme usually elongate, 3–6 cm. long in fruit; pod larger, 3–6 (averaging 3.5) cm. long; N. Coast Ranges, from Jackson County, Oregon, to Trinity County, California, eastward around the Klamath Basin to Lassen and Modoc counties ..... var. *siskiyouensis*

b. Pubescence spreading, of long hairs, always copious, the herbage gray-hirsute; leaflets crowded on a short rachis, the leaf-outline short and broad; Sierra Nevada, Placer and Nevada counties. . . . var. *lenophyllus*

a. Ovary pubescent; pod at least finely strigulose (d)

d. Raceme subcapitate, the axis not exceeding 1.5 cm. in fruit; flower small, the calyx-tube and teeth together 4–5 mm. long, the keel-petals 8–10 mm. long; herbage strigose; Cascade Mts., Washington (Chelan and Kittitas counties), to Blue and Steens Mts., Oregon, and central Idaho ..... var. *Sonneanus*

d. Raceme elongate, 1.5–4 cm. long in fruit; flower larger, the calyx 5.5–7.5 mm., the keel 12–13 mm. long; herbage loosely canescent with incumbent hairs. Northeastern California (Lassen to Modoc counties) and adjacent Oregon to northeastern Nevada and southwestern Idaho. . . .  
..... var. *confusus*

a. *A. WHITNEYI* Gray (typical)

*A. Whitneyi* Gray, Proc. Amer. Acad. 6:526, 1865, sensu strict. *A. Hookerianus* (T. & G.) Gray var. *Whitneyi* (Gray) Jones, Proc. Calif. Acad. Sci. II 5:668, 1895. *Phaca Whitneyi* (Gray) A. Hell., Muhlenbergia 9:67, 1913. Near Sonora Pass, Brewer (Gray Herb., type!)

*A. Whitneyi* var. *pinosus* Elmer, Bot. Gaz. 39:54, 1905. *A. Hookerianus* var. *pinosus* (Elmer) Jeps., Man. Calif., 564, 1925. *Phaca pinosa* (Elmer) Rydb., N. Amer. Fl. 24:341, 1929. *A. Whitneyi* subsp. *pinosus* (Elmer) Abrams, Ill. Fl. Pac. St. 2:583, 1944. —Griffin's, Ventura Co., California, Elmer 4005 (NY, isotype!).

*Phaca argentata* Rydb., N. Amer. Fl. 24:340, 1929.—Star Peak, West Humboldt Mts., Nevada, Heller 10633 (NY, type!, CAS).

Within the natural range outlined in the key, *A. Whitneyi* varies from nearly glabrous (on Mt. Pinos and in Inyo Co.) to densely strigose-cinereous (in the White Mts. and northern Nevada, *Phaca argentata*), the type being about intermediate in this respect. With each state of vestiture the banner varies between 9 and 15 mm. in length, the keel between 9 and 12 mm. Out of thirty odd collections studied, only one has calyx-teeth as long as 2 mm., the rest falling between 0.5 and 1.5 mm. The pod reaches extreme lengths of 1.5 and 3 cm. and is uniformly glabrous. The stems are commonly low, rarely exceeding 2 dm., the racemes are relatively compact, 1–3 or rarely 4 cm. long in fruit, and the leaflets tend to be remote, short and of thick texture. The flower is normally purple, but the color is fugacious in dried specimens.

b. *A. Whitneyi* var. *siskiyouensis* (Rydb.), comb. nov.

*Phaca siskiyouensis* Rydb., N. Amer. Fl. 24:340, 1929. *A. siskiyouensis* (Rydb.) Thompson, Leaflet West. Bot. 1:212, 1936. *A. Hookerianus* var. *siskiyouensis* (Rydb.) Peck, Madroño 6:134, 1941. *A. Whitneyi* subsp. *siskiyouensis* (Rydb.) Abrams, Ill. Fl. Pac. St. 2:583, 1944. —Mt. Eddy, Siskiyou Co., California, Eastwood 2006 (NY type!, CAS).

This entity is a weak one, variable in pubescence and flower-size to the same degree as *A. Whitneyi* proper, and separable only by the loose racemes of larger pods and generally greater stature. I have found no absolute quantitative difference in any one organ, but two distinct races evidently exist, their ranges sharply divided by the intrusion of var. *lenophyllus* in the Donner Pass region of the Sierra Nevada. The variety is best marked in the Coast Ranges, and as it passes eastward, especially along the Pit River in Shasta County, the larger flower begins to resemble that of var. *confusus*. A collection from near Susanville (Ripley & Barneby 5747) seems truly intergradient with *confusus*, some plants having glabrous, others strigulose pods; but the sparse, strigulose vestiture of the herbage is still that of *siskiyouensis*. The corolla appears ochroleucous in the herbarium, but is probably more or less purpletinged when fresh.

c. *A. Whitneyi* var. *lenophyllus* (Rydb.), comb. nov.

*Phaca lenophylla* Rydb., N. Amer. Fl. 24:341, 1929. *A. lenophyllus* (Rydb.) Tidestr., Proc. Biol. Soc. Wash. 50:21, 1937. —Tinker's Knobs, Placer Co., California, 24 July 1892, Sonne (NY, type!)

*A. Whitneyi* var. *Sonneanus* sensu Jeps., Fl. Calif. 2:347, 1946; non *A. Sonneanus* Greene.

The short congested leaves and dense hirsute pubescence make this a most distinctive entity, and despite the fact that it occupies a small island between *Whitneyi* to the south and var. *siskiyouensis* to the northwest, it is not known to intergrade with either. The pod is glabrous as in its immediate neighbors, but intermediate in size, with limits of 2 and 4 cm. in length. The flower is always small, and the petals appear ochroleucous when dry. The treatment in Flora of California is contradictory and confusing. While Jepson here accepted the substance of *Phaca lenophylla* as a "state" of *A. Whitneyi* characterized by "short leaves and . . . gray-hirsute herbage", and proposed for it the combination *A. Whitneyi* var. *Sonneanus*, he cited the basonym *A. Sonneanus* as originally a mere substitute and hence exact synonym of *A. Hookerianus* Gray (non Dietr.). But simultaneously Jepson stated that "*A. Hookerianus*", which he defined as an occasional and trivial, large-fruited form of *A. Whitneyi*, could not be recognized systematically. It is nonsense to maintain a var. *Sonneanus* on the one hand, and reduce *A. Hookerianus* outright on the other, if both are based ultimately on the same description and type, as may be confirmed by reference to the original publication of *Sonneanus*. It is possible that Greene may have had in mind one of several collections of *lenophyllus* secured by Sonne in the mountain above Truckee, but that is by the way. As it turns out, the epithet *Sonneanus* must stand for the plant originally collected by Douglas, never seen by Sonne himself, and not known to occur nearer to the California border than on Steens Mts. in southern Oregon.

d. *Astragalus Whitneyi* var. *confusus*, var. nov.

Legumine (2.5–6 cm. longo) striguloso, racemi laxiusculi axi 1.5–4 cm. longo, floribus inter speciei formas maximis (tubo calycino 5.5–7.5 mm., dentibus 1.5–2.5 mm., vexillo 14–16 mm., carinae 12–13 mm. longis), necnon pube laxiuscule incurva saepissime copiosa ab arcte affinibus distincta.

CALIFORNIA: Among sagebrush, mesa northwest of Alturas, Modoc County, alt. 4,500 ft., 31 May 1944, *Ripley & Barneby* 5992. Type in Herb. Calif. Acad. Sci. No. 324378. Lost Lake, Warner Mts., *J. T. Howell* 12142 (CAS). OREGON: Crane Mt. near Lakeview, Lake Co., *J. W. Thompson* 13207 (NY, Univ. Washington). NEVADA: Pole Creek, Burnt Timber Mts., Elko Co., *Nelson & Macbride* 2067 (NY). IDAHO: Silver City Mts., Owyhee Co., *Maguire & Holmgren* 26636 (NY).

Rydberg's inclusion of this variety, on account of its pubescent pod, in *Phaca Hookeriana* (var. *Sonneanus*, below) has been a source of confusion. Once the two are united, the resulting concept is as polymorphic or more so than a combination of the three varieties with glabrous pod defined above, and the incidence of a few hairs on the pod becomes its only character. Abrams pointed out the diverse nature of his subsp. *Hookerianus*, and refers directly to var. *confusus* as the plant of northeastern California with large flowers. Although its legume is strigose, *confusus* is more sharply distinguished from *Sonneanus* in its large flower, long calyx-teeth, loose raceme, loose incumbent

vesture and generally coarser habit, than from *siskiyouensis* with which, as shown above, it is known to intergrade. It seems significant that the more northern *Sonneanus* is a plant of exposed mountain crests, while the more southern *confusus* is in the sagebrush foothills of the Arid Transition. The fresh petals of var. *confusus* were noted as pale rose-color.

e. var. *SONNEANUS* (Greene) Jeps.

*Astragalus Whitneyi* var. *Sonneanus* (Greene) Jeps., Fl. Calif. 2:347, 1936, quoad nom., non descr. *A. Sonneanus* Greene, Pittonia 3:186, 1897. *Phaca Hookeriana*, T. & G., Fl. N. Amer. 1:693, 1840. *A. Hookerianus* (T. & G.) Gray, Proc. Amer. Acad. 6:215, 1864; non D. Dietr., Syn. Pl., 1086, 1850. *A. Whitneyi* subsp. *Hookerianus* (T. & G.) Abrams, Ill. Fl. Pac. St. 2:583, 1944. —“Interior of Oregon, probably near the Rocky Mts.” (presumably the Blue Mts.), Douglas (NY, isotype!)

The relatively slender, diffuse, small-flowered, strigose race of the Cascades, Blue Mountains and central Idaho varies greatly in size of pod (1.5–5.5 cm. long), but is otherwise pretty uniform in appearance. Although originally described as “glabrous”, the Douglas pods in the Torrey herbarium are plainly strigose. As remarked by Howell (Leaflet West. Bot. 2:74,—1938), the necessity for taking up the epithet *Sonneanus* for this extra-Californian plant is unfortunate; but in the varietal rank there is no alternative.

*Astragalus mohavensis* Wats. var. *hemigyris* (Clokey), comb. nov.

*A. hemigyris* Clokey, Madroño 6:220, Pl. 27, fig. p–z, 1942.

*A. albens* sensu Jones, Rev. Astrag., 261, pro max parte, exclus. Pl. 66, 1923; non Greene.

NEVADA: Indian Springs, Charleston Mts. Clark Co., C. B. & I. W. Clokey 8409 (NY, isotype), Jones (POM). CALIFORNIA: Darwin Mesa, Inyo Co., Ripley & Barneby 3772 (CAS, RB).

It is with reluctance that I propose the reduction of this species to varietal rank, but it now seems possible to maintain it only if it is restricted to the population in the foothills of the Charlestons, and if one ignores those races of *A. mohavensis* in which the pod is arcuate and dorsally sulcate. Clokey compared *hemigyris* with *A. Layneae* Greene, by no means closely related or similar. On the other hand there is no tangible detail of habit, pubescence, calyx or corolla in which *hemigyris* and *mohavensis* fail to agree. In both the pod is fleshy and terete or nearly so when first formed, in typical extreme *mohavensis* broadly oblong and slightly enlarged upward, straight or nearly so and obtuse at both ends, in typical extreme *hemigyris* oblanceolate, arched through half a circle and acutish at both ends. But these are the extremes. The pod of *mohavensis* is quite variable in form, and as the juicy tissues shrink in ripening, the walls collapse in various ways. When the pod is straight both sutures remain convex, while the lateral angles fall inward and the cross-section becomes roughly rhombic (cf. Jones, Rev. Astrag. Pl. 72), with greatest diameter between the sutures. As the pod becomes longer relative to its width and more strongly incurved the dorsal suture collapses, a groove develops on the dorsal side, and the section becomes obcordate. At this point the pod differs from that of typical *hemigyris* only in being shorter and less arcuate. The

cited collection from Darwin has pods 15–23 mm. long, about 5 mm. in diameter, definitely sulcate dorsally, and the curvature reaches in some cases to one quarter of a circle. In *hemigyris* proper the pod is 20–30 mm. long, 4–5 mm. in diameter, and arched through half a circle. In the absence of other characters I am forced to consider these conspecific. The extreme forms of the species can be defined as follows:

- a. Pod plumply oblong, straight or nearly so, with both sutures elevated and prominent at maturity, the cross-section rhombic-elliptic. . . *A. mohavensis*
- a. Pod oblanceolate, definitely and sometimes strongly falcate, the dorsal suture depressed and sulcate at maturity, the cross-section obcordate. . . . .
- .....var. *hemigyris*

**A. MULFORDAE** Jones, Contr. W. Bot. 8:18, 1898.

**CALIFORNIA:** Near Owen's River, east of Whitmore Tubs Springs, Long Valley, Mono Co., *J. T. Howell 14383* (CAS).

A most unexpected addition to the state flora. The species is known otherwise only from a small area in the lower Snake River valley in southwestern Idaho and adjacent Oregon. The stipe of the pod (about 1.5 mm. long) in Mr. Howell's plant is at the low extreme for the species; but there seems to be no other difference.

***Astragalus cimae*** Jones var. *sufflatus*, var. nov., a prole typica leguminis subdimidio majoris valde inflati (3–3.5 cm. longi, 12–15 mm. lati) valvulis chartaceis (nec coriaceis crassis), suturisque filiformibus haud elevatis absimilis.

**CALIFORNIA:** 15 miles north of Darwin, Inyo Co., alt. 5,000 ft., 29 May 1939, fr. *Edmund Jaeger*. Type in herb. Pomona College No. 248788. Timbered mountain slopes, head of Saline Canyon, northwest of Panamint Valley, 2 May 1937, fl. and young fr., *Percy Train* (Herb. Oberlin College).

Typical *cimae* is a rare plant of the eastern Mohave Desert, known to me only from the sagebrush plateau and calcareous foothills of the New York Mountains and from the "Mid Hills" (*Jaeger*, POM). The pod, well illustrated by Jepson (Fl. Calif. 2: fig. 212), has fleshy valves which ripen to a woody texture, with both sutures prominent, raised and thickened, the dorsal undulate and cordlike. The body of the pod varies from 1.5–2.5 cm. in length and reaches a maximum diameter of 1 cm. In var. *sufflatus*, essentially similar in foliage, pubescence and flower, the pod is strongly inflated, 3–3.5 cm. long and 12–15 mm. in diameter, with valves ripening to parchment texture and filiform sutures. The areas occupied by the two varieties lie about 150 miles apart. Both range in altitude from five to six thousand feet.

***Astragalus Minthorniae*** (Rydb.) Jeps. var. *villosus*, var. nov., a prole typica caulibus, foliorum rachi, foliolisque pube e pilis patulis incurvis (nec rectis arcte appressis) constituta undique villosa-canescens. —*A. Minthorniae* sensu Jeps., Fl. Calif. 2:69, 1936; Munz, Leaflet West. Bot. 3:84, 1941; Clokey, Madroño 6:220, 1942; non *Hamosa Minthorniae* Rydb., sensu stricto.

**CALIFORNIA:** Inyo Mountains, 12 miles east of Zurich, Inyo Co., alt.

7,200 ft., 18 May 1944, *Ripley & Barneby 5883*. Type in Herb. Calif. Acad. Sci. No. 324371; isotypes in herb. Gray, NY, Rancho Sta. Ana Bot. Gard.

As it occurs in eastern Nevada, from Pioche, Lincoln Co. (*Minthorn 77*, NY, type!; *Ripley & Barneby 3547*) northward in the foothills of the limestone mountains to Ely, White Pine Co. (No. 6300), *A. Minthorniae* has strictly appressed-strigose stems and herbage, only the pilose calyx and villous pod bearing loose hairs. The present variety, softly villous throughout, occupies an apparently disjunct area to the west. It extends from the Charleston Mts. in southern Nevada (cf. Clokey, l. c.) to the eastern Mohave Desert (Barnwell, *Ripley & Barneby 3310*), north to the Inyo Range, and recurs in the calcareous island on the desert slope of the San Bernardino Mts. at Cushenbury Canyon (No. 2859, RB).

***Astragalus Andersonii* Gray var. *sepultipes*, var. nov.**, a prole typica floribus majoribus, calycis tubo 5–6 (nec circa 4) mm., vexillo 18–19 (nec 9–14) mm., carinae 11.5–12 (nec 7–9) mm. longis, pube sericea subappressa vix hirsuta, necnon caulibus ad basin gracilioribus haud dense hirsuto-tomentosis e radicis collo subterraneo emissis valde diversa. —*A. Andersonii* sensu A. Hell., *Muhlenbergia* 2:217, 1906, et auct. pro parte.

CALIFORNIA: foothills west of Bishop, Inyo Co., alt. about 5,000 ft., 31 May 1906, fl. & fr., *A. A. Heller 8357*. Type in Herb. Calif. Acad. Sci. No. 63686; isotypes NY and widely distributed.

The Owens Valley *Astragalus* passing as *Andersonii* was noticed by Jones (Rev. Astrag., 261) as having larger flowers and fruits than the typical form, but its other peculiarities have been generally overlooked. On the type-sheet Miss Eastwood calls attention to the "more silvery" pubescence which, while still composed of somewhat contorted and tangled hairs, is subappressed, silky and shining rather than dull and villous-hirsute as in typical *Andersonii* from Mono County northward. In the latter the stems arise from buds on the woody root-crown at the level of the soil, and the lowest two or three internodes are more densely pubescent than the rest, the base of the plant, as in *A. Lyallii* Gray, being in fact coarsely white-tomentose. Heller's plant has an apparently subterranean caudex, and the lower internodes, more slender than the rest, are buried in the soil and glabrescent or merely strigose. Modifications of life-form, from cryptophyte to hemicryptophyte and vice versa, are not uncommon in the genus, but nearly always accompany fundamental changes in other organs, and I know of no case in which both types occur in one species. However, the flower and fruit of var. *sepultipes*, in spite of their increased size, do not differ appreciably in form from those of normal *Andersonii*. Further collections may yet show it to be a distinct species.

***Astragalus tener* Gray var. *Titi* (Eastw.), stat. nov.**

*A. Titi* Eastw., Bull. Torr. Club 32:195, 1905. *A. tener* sensu auct. plur., pro parte.

CALIFORNIA: Moss Beach (now Moss Landing), Monterey Co., Mrs. Clemens in 1904 (CAS, type). Near Pacific Grove, Dr. F. H. Titus (fide Eastw., l. c.). Santa Monica, Los Angeles Co., Dr. Hasse (NY). Hyde Park within the



present Inglewood\*), Los Angeles Co., *Abrams* 3251 (CAS, NY). Soledad, San Diego Co., *Jones* 3155 (CAS, NY, POM). Silver Strand near Coronado, San Diego Co., *Edith Purer* 7479 (San Diego Museum).

While discussing an isotype of *A. tener* on loan from Leningrad, Howell (Leaf. West. Bot. 2:140) pointed out that the type of *A. Titi*, universally reduced to the synonymy of *tener*, had flowers only half as large. This is approximately true of all collections referred to the species from near the coast southward from Monterey Bay, and these seem to represent a substantial geographic entity. Typical *tener* is native to alkaline grassy flats in the central Great Valley, the San Francisco Bay region and the lower Salinas Valley, while var. *Titi* has been found only near the coast, within the belt of immediate oceanic influence. The metric differences, though not large, are considerable in proportion to the whole:

- a. Calyx 3-4 mm. long, the tube 2 mm., the teeth 1-2 mm. long; banner 8-10.5 mm., keel 5-5.5 mm. long. . . . . *A. tener*
- a. Calyx 2.5-3 mm. long, the tube 1.5-2 mm., the teeth 1 mm. long or less; banner 5-6 mm., keel 3.5-4 mm. long. . . . . var. *Titi*

ASTRAGALUS PAUPERCULUS Greene, Pittonia 3:224, 1897.

*A. tener* var. *Bruceae* Jones, Rev. Astrag., 268, 1923. *Hamosa Bruceae* (Jones) Rydb., Bull. Torr. Club 54:323, 1927. *A. Bruceae* (Jones) Abrams, Ill. Fl. Pac. St. 2:603, fig. 2893, 1944.

I feel pretty well satisfied that *pauperculus* should be taken up as the earlier name for *Bruceae*, and that it can be referred neither to the synonymy of *A. tener* Gray, as is the general practice, nor to that of *A. Rattani* Gray, as claimed by Jones in the index to Revision of Astragalus. Greene did not specify a type for *pauperculus*, merely stating: "a diminutive species, first collected by myself now more than 20 years since, on a dry hillside of the upper Sacramento, but in flower only . . . Fruiting specimens sent in recently from the same district indicate its close relationship to [*A. tener*] and *A. Rattani*." I have been unable to visit the Greene Herbarium with this problem in mind, but (apart from agreement in every detail of the description) it is suggestive that *Bruceae* is endemic to dry hillsides of the upper Sacramento in Butte, Shasta and Tehama counties, whereas *tener* is a plant of the valley floor and is not known to extend north of Solano County. Moreover Greene must have been familiar with *tener*, at that time not uncommon around Berkeley. Greene's description of the pod rules out the possibility that he had *Rattani* in mind.

ASTRAGALUS CLARIANUS Jeps., Man Calif., 578, fig. 570, 1925. *Hamosa Clariana* (Jeps.) Rydb., N. Amer. Fl. 24:427, 1929, quoad nom., exclus. descr. et distrib. *A. Rattani* var. *Clarianus* Jeps., Fl. Calif. 2:379, 1936.

The type of this rare little species, apparently confined to grassy hills in the St. Helena region in Napa and Sonoma counties, has not been available (Herb. Jepson), but the beautiful figure in Jepson's Manual identifies it beyond all doubt. This clearly shows the prominent keel-petals, which surpass

\*For identifying this station I am indebted to Mr. L. S. Rose.

and are nearly twice broader than the narrow wings. The keel of *A. Rattani*, its nearest relative, is shorter and narrower than the wings, about 2 mm., as opposed to 2.5–3 mm., wide at apex. The true *Clarianus* has latterly been confused with a form of *Rattani* with spreading arcuate pod which inhabits the inner North Coast Range, and which is noted by Jepson (Fl. Calif. 2:379) as a distinct, though unnamed race. The material named *Clarianus* by Rydberg (NY), and Figure 2895 in Abrams's Illustrated Flora, as well as the wide distribution, "Northern California", or "northern Coast Ranges and Sacramento Valley" given by these authors, are all to be associated with *A. Rattani*.

Typical *A. Rattani* of the outer Coast Ranges in Humboldt and Mendocino counties has a straight and nearly erect pod 3–6 cm. long and relatively large flowers with banner 10–12.5 mm. and keel 6.5–8 mm. long. The form from the interior with which *A. Clarianus* has been confounded has an arcuate and spreading pod 2–3.5 cm. long and slightly smaller flower with banner 8–9.5 and keel 4–5 mm. long. It ranges from eastern Mendocino to Colusa, Lake and Napa counties. I have seen one or two intermediate specimens, however, and incline to think that it may be no more than an edaphic response.

ASTRAGALUS DIDYMOCARPUS H. & A., sensu lato.

While readily adopting Jepson's broad view of the species, I find that the varieties listed in Flora of California need redefinition. The principal races, as I understand them, can be discriminated as follows:

- a. Flower small, the keel 3–4 mm. long (b)
  - b. Calyx (including the teeth) 2.5–4 mm. long, the shortly campanulate tube 1.5–2 mm. long (c)
    - c. Calyx, or at least the teeth, partly black-hairy, the teeth equalling or commonly shorter than the tube; stems characteristically erect; herbage often greenish, the leaflets glabrescent above; San Joaquin Valley (south from Contra Costa Co.); cismontane southern Calif.; Channel Islands; southwest Mohave Desert; to northern Baja California. . . . .*A. didymocarpus* (typical)
    - c. Calyx densely white-villous, the teeth usually well, or at least slightly surpassing the tube; stems characteristically prostrate; herbage densely canescent; southern Mohave and Colorado deserts, to Arizona and Sonora . . . . .var. *dispermus*
  - b. Calyx 4.6–5 mm. long, the narrowly campanulate tube 2.5–3 mm., the teeth 1.8–2 mm. long; upper Salinas and Cholame valleys, San Luis Obispo County . . . . .var. *daleoides*
- a. Flower larger, the keel 5.5–7 mm. long (d)
  - d. Keel abruptly incurved and rounded-obtuse at apex; coastal San Luis Obispo and Santa Barbara counties. . . . .var. *Milesianus*
  - d. Keel attenuate into a narrowly triangular apex; interior cismontane California, along the edge of the desert from Los Angeles County to northern Baja California. . . . .var. *obispensis*

a. *A. DIDYMOCARPUS* H. & A. (typical)

*A. didymocarpus* H. & A., Bot Beechey Voy., 334, Pl. 81, 1838. *Hesperastragalus didymocarpus* (H. & A.) A. Hell., *Muhlenbergia* 2:87, 1905.

*A. catalinensis* Nutt., Proc. Acad. Philad. 4:9, 1848.

*Hesperastragalus compactus* A. Hell., *Muhlenbergia* 2:218, 1906.

As received by Jepson (Fl. Calif. 2:376) with the exception of Munz 5096 (POM), here referred to var. *obispensis*. The typical form passes directly into var. *dispermus* where their ranges meet in the southwestern Mohave Desert; and some slender plants from arid sites in the Great Valley (e.g. *J. T. Howell* 5870, from Oil Fields, Fresno Co.), which combine the radiating stems of *dispermus* with the calyx of *didymocarpus* proper, suggest a further passage between the two. The eastern limit of the typical form is uncertain. I have seen no record from the central or eastern Mohave Desert, but it should be there, if a plant from Nye County, Nevada (west of Rhyolite, *C. L. Hitchcock* 6183, NY) is correctly identified. It is possible that *A. catalinensis* should be maintained as a separate entity, marked by linear leaflets and rather long hairs on the pod; but these characters are not satisfactorily correlated in the material I have seen from Catalina and the San Diego County coast.

b. var. *DISPERMUS* (Gray) Jeps.

*A. didymocarpus* var. *dispermus* (Gray) Jeps., Fl. Calif. 2:376, 1936. *A. dispermus* Gray. Proc. Amer. Acad. 13:365, 1878. *Hesperastragalus dispermus* (Gray) A. Heller, *Muhlenbergia* 1:137, 1906.

I follow Jepson here with only one reservation; the record from cismon-tane Riverside County should be reexamined on the chance that it may prove to be var. *obispensis*. The variety is not otherwise known to extend beyond the desert.

c. *A. didymocarpus* var. *daleoides*, var. nov.

A prole typica, cui proxime affinis, calycis tubo anguste campanulato elongato 2.5–3 mm. longo, dentibus 1.8–2 mm. longis vexillo vix brevioribus carinam longe superantibus absimilis.

CALIFORNIA: Cholame, San Luis Obispo Co., 5 May 1926, *Eastwood* 13875, in part; *ibid.*, 25 March 1935, *J. T. Howell* 2026, in part. Cotypes in Herb. Calif. Acad. Sci. Nos 139876, 221677. San Miguel, San Luis Obispo Co., *Chester Dudley* in 1936 (CAS).

Both collections from Cholame are mixed with typical *didymocarpus*, raising a question as to whether the variety is more than a casual or occasional modification of the species, and further collections are needed to establish its status. The elongate, densely hirsute calyces, with their long teeth equalling the banner or nearly so, are unlike anything seen elsewhere in the range of *didymocarpus*. In early anthesis the heads of flowers are quite like those of some annual *Daleas*.

d. var. *MILESIANUS* (Rydb.) Jeps.

*A. didymocarpus* var. *Milesianus* (Rydb.) Jeps., l. c., 1936. *Hesperastragalus Milesianus* Rydb., Bull. Torr. Club 53:169, 1926.

This large-flowered coastal phase is now known to extend from San Luis Obispo southward into Santa Barbara County, where it has been collected

near Buellton and Gaviota. The pod was originally described as glabrous, but may bear a few hairs towards the extremities of the valves (e.g. *J. H. Barber in 1899*, from Morro, San Luis Obispo Co., Univ. Calif.)

e. var. *OBISPENSIS* (Rydb.) Jeps.

*A. didymocarpus* var. *obispensis* (Rydb.) Jeps., l. c., 1936, as "*obispoensis*". *Hesperastragalus obispensis* Rydb., Bull. Torr. Club 53:167, 1926.

CALIFORNIA: west of Palmdale, Los Angeles Co., *Ripley & Barneby 3261* (RB). South of Hemet, Riverside Co., *G. T. Hastings in 1941* (NY). Dripping Spring near Temecula Creek, Riverside Co., *Munz 5096* (POM). Between Jacumba and Mountain Springs, San Diego Co., *Eastwood 9542* (CAS). Warner's Hot Springs, San Diego Co., *Eastwood 2601* (CAS, NY).

BAJA CALIFORNIA: Valley of Palms, *Jones in 1882* (NY).

The type of *H. obispensis* consists of two imperfect plants of the *didymocarpus* alliance mounted with one of *A. Gambelianus* Sheld. over the common label: San Luis Obispo, *Jones 3229* (NY). As noted by Rydberg (ex char.), the duplicates of this collection are pure *Gambelianus*, and there is a strong probability that the *obispensis* element was introduced by mischance, either in distribution or in mounting. In any case we have no record of a similar plant from coastal central California; whereas the specimens, so far as can be made out in their present condition, closely match a form of *didymocarpus* from the interior valleys and desert-bordering foothills of Southern California which I have for long considered undescribed. This race resembles var. *dispermus* in the usually white-hairy calyx, and is commonly found in herbaria under that name. But it differs in the larger flower, and more importantly in the shape of the keel-petals, which are not abruptly incurved and obtuse, but attenuate into a narrowly triangular apex. Rydberg, correctly describing the keel of *obispensis* as "attenuate at apex", further characterized the species as having glabrous pods, and when Jepson came to maintain it as a variety this was the only character conceded as significant. Unhappily the pod of the type is so far from glabrous that the whole distal half, especially on the dorsal side, is beset with short, subappressed trichomes, and this is true of all material studied by me. Thus the idea of a glabrous-fruited *didymocarpus* with white-hairy calyx being found in San Luis Obispo County seems to have arisen from faulty observation and questionable data of locality; in fact, as treated by Jepson, var. *obispensis* is a chimera. As defined here the variety has a continuous range between altitudes of 1,500 and 3,000 feet in the hills and valleys of interior cismontane Southern California, within the range of desert influence, but west of the desert itself.

I have been unable to find specimens representing *A. didymocarpus* x *dispermus* Jones, Rev. Astrag., 285, 1923, from Banning, California, but it may well have been based on specimens of this variety.

ASTRAGALUS GAMBELIANUS Sheld. var. *ELMERI* (Greene) J. T. Howell, Leaf. West Bot. 5:107, 1948. *A. Elmeri* Greene, Erythea 3:98, 1895.

Despite the extensive ranges indicated by Rydberg (N. Amer. Fl. 24:458, as *Hesperastragalus*), and by Abrams (Ill. Fl. Pac. St. 2:610, as *A. Gambelianus* subsp.), this seems to be a highly localized form, apparently confined to the

flanks of Mt. Tamalpais in Marin County. Rydberg, and consequently Abrams, evidently transferred the name from the rare large-flowered plant described by Greene ("Corolla nearly  $\frac{1}{4}$  inch long"—ex char.) to a coastal form of *Gambelianus* with ascending-hirsute rather than curly-villous pod. Perhaps Rydberg was influenced by Greene's description of the pod as "strigulose", untrue, for example, of the copious topotypes secured in Ross Valley by Michener & Bioletti as early as 1892 (NY, two sheets), where the vesture of the pod is exactly that of typical *Gambelianus*. In fact Rydberg excluded these gatherings from *Elmeri* altogether, and they are labelled "*Hesperastragalus nigrescens*" (a synonym of *A. Gambelianus*) in his hand; whereas everything, except the type, cited as *Elmeri* (in Bull. Torr. Club 53:168) and so annotated (NY) is of the tiny-flowered *Gambelianus* with appressed-pubescent pod. Evidently this latter form, which ranges from Contra Costa to Los Angeles County, is undescribed, and should perhaps receive a name. In any case *Elmeri* can be maintained as distinct from *Gambelianus* only on the larger corolla, which can be quite striking, the banner reaching 6 mm. in length as opposed to an average 3 mm. in widespread *Gambelianus*. The Michener & Bioletti topotypes, however, are unstable in respect to flower-size, varying into a small extreme barely, if at all, separable from normal *Gambelianus*, and the appropriate category for *Elmeri* is probably that of forma.

#### SPECIES EXCLUDED FROM THE FLORA OF CALIFORNIA

*Astragalus anemophilus* Greene.

"San Miguel Island", Rydberg (N. Amer. Fl. 24:349, as *Phaca vestita*); but the corresponding specimen (NY) so labelled by Rydberg is apparently *A. miguelensis* Greene.

*Astragalus convallarius* Greene.

Two sheets labelled "Summit, Calif., 21 June 1890, M. E. Jones" and "Summit, near Jackson, Jones" are preserved at Pomona. The known western limit for the species is in Eureka Co., Nevada, about 200 miles east of Donner Pass. Unless brought in as a waif along the railroad, *A. convallarius* could hardly exist in the unsuitable environment of Summit. Furthermore, if collected in 1890, it could hardly have gone unnoticed by Jones in the Revision of *Astragalus*.

*Astragalus Douglasii* var. *glaberrimus* Jones.

"Southern California," Rydberg (op. cit. 345, as *Phaca glaberrima*). I have no concrete evidence that this distinctive Lower Californian *Astragalus* extends north of the border.

*Astragalus Douglasii* var. *piscinus* Jones.

"Algodones Sand Hills, Jepson 11720", Jepson (Fl. Calif. 2:350, as *A. Crotalariae* var. *piscinus*). The identity of this specimen will need checking when the Jepson Herbarium becomes available. The description in Flora of California is at variance in several respects with true *piscinus*, which came from Sebastian Vizcaino Bay, Lower California. I suspect it will prove to be *A. niveus* (Rydb.) Barneby, the common hoary "Phaca" of the Algodones dunes, not otherwise mentioned by Jepson.

*Astragalus Spaldingii* Gray.

"Honey Lake", Jones (Rev. Astrag., 173). Doubtless an error, and probably based on misdetermined specimens of *A. Andersonii* Gray, a related species common in southern Lassen County. True *Spaldingii* is unknown from south of the Blue Mountains in northeastern Oregon.

*Astragalus succumbens* Dougl.

"Butte County, Eggleston 7335", Rydberg (Bull. Torr. Club 54:14, as *Hamosa*), an impossible station for this species, endemic to sandhills along the lower Columbia River. The record was subsequently dropped by Rydberg (N. Amer. Fl. 24:419).

Wappingers Falls, New York  
March 1950